

**Characteristics of Cortical Visual Impairment**  
**By Francey Liefert**  
**March 17, 2008**

*Remember Samantha, Juan and Andrea*

*In the first two units of "Introduction to Low Vision" you were introduced to three students who have low vision due to trauma at birth. Samantha, Juan and Andrea all have some brain injury as well as visual impairment. They have slow reaction time to any stimulus. Juan has problems with organization and is always losing his school equipment. He has been diagnosed with retinopathy of prematurity, and his teacher suspects that he also has cortical visual impairment due to his disorganized and slow processing behavior. Samantha has motor problems, her speech is hard to understand, and she has trouble remembering events in sequential order. Her vision condition has been diagnosed as cortical visual impairment, and her acuity, the ability to see details, is reported to be very reduced. Andrea also has been diagnosed with cortical visual impairment and motor problems. She has tripped on so many small changes in terrain that she walks very cautiously and hesitates to step into a shadowy area.*

Cortical visual impairment (CVI) is a vision condition that originates from damage to or malformation of the brain rather than the eye. Some aspects of CVI remain a mystery, and new information is being discovered all the time by doctors, teachers and researchers. Some professionals define CVI as visual impairment resulting from birth trauma alone, and others consider visual impairment from any brain trauma to be CVI. Renaming it "neurological visual impairment" or "cerebral visual impairment" has been suggested because there are many parts of the brain besides the visual cortex which interpret visual images. For the purposes of this paper, the common term of CVI will be used to refer to any visual impairment which is a result of brain damage or malformation.

The first hallmark of CVI is fluctuating vision. This can be frustrating not only to the people who have CVI, but to those working with them. It may appear that students who have CVI are playing games about what they can and cannot see. These are the students whom people get impatient with, saying, "He saw that yesterday! I don't know why he can't see it today!" Unfortunately, that is just the nature of cortical visual impairment. Maryke Groenveld, PhD, R. Psych., who has worked with hundreds of children who have CVI in Canada, suggested that the visual fluctuation may actually be a difficulty in perceiving objects as being the same when they are seen in different lighting or from a different angle and so appear to have a different shape. In other words, the appearance of the visual target may be different, and the brains of people who have CVI may not be able to interpret this new image as the same object that was seen earlier. This explanation does not cover all the instances in which people who have CVI demonstrate fluctuating vision. Often people who have CVI learn to express when they are having a good vision day or a bad vision day. That way their teachers and supervisors can alter activities and expectations accordingly.

Seeing and processing what is seen takes a lot of energy and attention for people who have CVI. It is important that nothing else is distracting them when they are trying to use vision. It is hard for a person who has CVI to use vision when she is having difficulty maintaining posture on the floor or on a chair or when he is distracted by other sensory input, such as interesting sounds or voices, visual displays on the walls or activities in which other students are engaged. In order to use visual attention, people who have CVI need good physical support and little or no distractions. Juan's trouble with organization skills may have to do with this kind of difficulty in putting his attention to more than one thing at a time.

People who have CVI need extra time to process visual information. Here's a description of how this may look: Often young children who have CVI or people who have had a recent brain injury, look at an object, look away, and then reach for the object without turning their eyes back to it. They need the processing time both to understand the input from their eyes and to command their hand where to move. The delay in processing tends to decrease as the person who has CVI matures and as a brain injury heals. This delay and looking away from the visual target may feel natural to the person who has CVI, but it may frustrate those working with her. Complaints of, "Look at this!" and "How can I tell if you're listening to me if you're not looking at me?" are common. Of course, such complaints just add one more layer to process for the person who has brain injury, adding to the delay in reacting to the visual target. It is important to accept that a person who has brain damage takes longer to react to any stimulus. Slowing down and waiting quietly will help the most.

Another characteristic which causes people who have CVI to not look straight at a visual target is the fact that everyone who has CVI has a loss in their visual fields. They may not see with their central vision and may need to tilt their heads or look out of the corner of their eyes to see best. This is referred to as "eccentric" viewing. Fully sighted people tend to interpret that behavior as not looking at the target. When working with someone who has CVI, remember that there is a large loss in periphery vision in both eyes, usually to one side or the other, or in the superior or inferior fields. A person who has CVI may also have blind spots within the fields which he or she uses. This is referred to as "Swiss cheese vision" because it is similar to looking through the holes in a piece of Swiss cheese. It is important to find out where the fields are missing so that you can present visual material to the remaining field for the best visual access. Andrea appears to be looking past her assistant when she is talking to her. At first it was confusing to the assistant, but now that she has observed Andrea viewing objects with her side vision, she understands more. The assistant has helped Andrea explain her eccentric viewing to other adults who work in the classroom.

People who have CVI often move close to the object which they are trying to view, even when their acuity measurements may indicate that they could see the object from further away. This is yet another trait that goes against the common wisdom for how to use vision best. How many times did your parents tell you to back away from the TV set or hold your book upright or not get your nose next to your painting? Dr. Groenveld suggests that by moving in close to a visual target, people who have CVI eliminate some of the background clutter from their view, allowing them to see their target more clearly.

It is difficult for people who have CVI to distinguish between a cluttered background and the visual target on which they are trying to focus. For example, if a person is wearing a Hawaiian shirt and holding a flower, people who have CVI may not see the difference between the flower and the shirt pattern. To help students who have CVI see best, it is important to use a plain background which contrasts well with the visual targets.

Confusion between the background and the visual target creates Andrea's hesitancy to walk in shady areas. It is hard for her to determine what is a shadow and what is a change in terrain. She feels most comfortable when there is high contrast between different visual targets. The steps indoors at her school have yellow markings on each black step, and she walks up and down them confidently. In a similar manner, Juan reads best when he can use equipment which allows him to have a black background and white letters for his reading material. Reduced contrast sensitivity is often present in people who have CVI.

People who have CVI sometimes have difficulty distinguishing between objects when they are close together or touching each other. A pile of papers or crayons on a table may look like a solid object rather than a collection of objects to a person who has CVI. They may see the outline of the pile, but not the outlines of the individual objects in the pile. Likewise, they may see the outline of pictures, but not the inner detail. When Samantha's teaching assistant helps her make scrapbook pages, she is careful to place each item on a plain background with plenty of space around it.

People who have CVI have a similar problem with reading. They see the first and last letters of a word, but not the letters in the middle of the word. This is referred to as difficulty with "crowding," even though fully sighted people would not consider words printed in a book to be crowded at all. Sometimes optometrists report two significantly different acuities for people who have CVI; one is taken from viewing a single symbol at a time, and the other is from viewing the typical eye chart with lines of symbols. The single symbol acuity is invariably better.

Due to the factors just discussed, it is not surprising that people who have CVI often have difficulty describing what is featured in photos or drawings. Often they need to have a verbal "tour" of pictures in order to make sense of what they are seeing. After having a picture described just once, a person who has CVI can

usually identify the picture reliably on subsequent viewings. A lot of frustration can be avoided by pointing out features in a picture, graph or drawing before asking the student who has CVI to talk about what is being viewed. Samantha's assistant points out the features in each photo they include in her scrapbooks. When Samantha gets them home, she can identify almost all of them for her parents.

Color may attract the visual attention of a person who has CVI, particularly if this is a child or a newly injured person. Yellow and red toys are often found to be especially attractive. If your student has a favorite color, you may want to color code items in the classroom to facilitate the student finding and identifying them.

The acuity of a person who has CVI may be improved if the visual target is moving or if the person who has CVI is moving. Juan was labeled dyslexic. When he had just completed sixth grade, and his teachers were worried that he wouldn't be able to read the textbooks in junior high school. He worked hard during summer school to improve his reading ability, but the textbooks still proved nearly impossible for him. On a field trip he spotted the lighted ticker-tape style signs at the rapid transit station. He read every word that came across the screen without hesitation. The difference was not the length of the words or the enthusiasm for the message. The difference was in the contrast between the lit-up, orange letters and the black background and the fact that the words were moving across the screen. Fortunately for this young man, there is software available that allows the user to create the amount of contrast needed and that moves the print across the computer monitor in a similar fashion. By using that software and downloading his textbooks onto a computer, Juan now has a chance to show his true academic skills.

The software may also provide relief for another hallmark of CVI: trouble with glare. By changing the computer monitor setting to black background with white letters, a student can cut down the glare from the monitor considerably. Other ways to handle glare are as simple as wearing sunglasses and a hat with a dark brim, avoiding facing a light source, such as an open door or an uncovered window and turning TV screens and computer monitors away from light sources. Once again, acuity rises when glare is not clouding the vision.

Ironically, some people who have CVI enjoy staring at lights. This is harmless if it isn't the sun that they're staring at, and if staring at the lights isn't distracting them from doing other activities.

The good news about CVI is that it is not uncommon for children born with CVI and people who have cortical visual impairment due to a brain injury to regain some vision as they grow older or recover from the injury. This usually happens within the first few years of life in young children and within the first few weeks after a brain injury, but it has been seen to happen during longer periods.

In summary, when you work with students who have CVI, it is important to take into consideration the accommodations that are likely to be needed:

- Allow time for processing;
- Expect fluctuating vision and watch for visual fatigue;
- Accept eccentric viewing;
- Provide physical support as needed, especially head support;
- Eliminate visual and auditory distractions;
- Separate items or images and space symbols and letters well;
- Present material on a highly contrasting, plain background;
- Allow the student to move or move the material if needed to facilitate vision use;
- Eliminate glare;
- Use color to attract visual attention;
- Explain what is being viewed before asking what the student sees.

## References

Good, William V., Jan, James J., Burden, Susan K., Skoczenski, Ann, & Rowan, Candy. *A Recent Advances in Cortical Visual Impairment*. Developmental Medicine and Child Neurology, 2001.

Groenveld, Maryke. *Characteristics and Needs of Children with Cortical Visual Impairment*. Paper presented at Lowenfeld-Akeson Symposium, 1998.

Roman-Lantzy, Christine. *Cortical Visual Impairment: An Approach to Assessment and Intervention*. American Foundation for the Blind Press, 2007.